REMARKS

The specification of the application, as filed, as constituted by the verified translation of PCT/DE03/00672 has been cancelled in favor of the concurrently submitted Substitute Specification. A suitable Abstract of the Disclosure has been provided. These changes and additions do not constitute any new matter.

Original claims 1-29, Article 19 claims 1-29, replacement claims 1-27 and further replacement claims 1-23 have all been cancelled. New claims 30 to 69 have been added. New claims 30 to 69 are essentially the same, in scope, as the claims now pending in the PCT application. They have been rewritten in a form more in accordance with U.S. practice.

Entry of this Preliminary Amendment into the subject application, prior to the calculation of the filing fee, and prior to an examination of the application on the merits, is respectfully requested.

Respectfully submitted,

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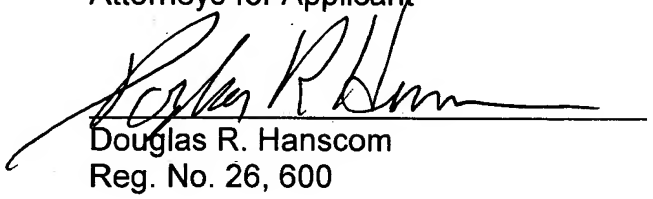

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[WO 03/086923] [PCT/DE03/00672]

MARKED UP COPY OF SPECIFICATION

BOLZA-SCHÜNEMANN - W1.1917PCT-US

[Specification]

Devices for Aligning Sheets and Method for Aligning Sheets Transversal to the Direction of Travel of the Sheets

CROSS REFERENCE TO RELATED APPLICATIONS

This application is the U.S. national phase, under 35 USC 371, of PCT/DE03/00672, filed February 28, 2003; published as WO 03/086923 A2 and A3 on October 23, 2003, and claiming priority to DE 102 16 355.3, filed April 13, 2002, the disclosures of which are expressly incorporated herein by reference.

FIELD OF THE INVENTION

The present invention is directed [relates] to devices for aligning sheets and to a method for aligning sheets transversely to the direction of travel of the sheets [in accordance with the preambles of claims 1, 2, 4, 5, 7 or 29]. A holding device, which transports a sheet, is arranged to move the sheet against a side mark.

BACKGROUND OF THE INVENTION

Pull guides are known in various embodiments, which guides pull each sheet, mainly by static friction, against a fixed stop, [-]the actual side mark. After arriving at the side mark [there], the sheet can immediately come to

rest, because the pulling mechanism, which is only in slight contact with it, continues to pull on the sheet. However, [but] the static friction immediately is switched to sliding friction.

Driven pulling rails, pulling rollers or pulling segments are used [exist] in a [the] sheet-feeding table. If the sheet has arrived at the front marks, it is first pushed from above on the driven portion of the pulling device underneath the sheet by the use [means] of a roller, which can be precisely adjusted, which roller is spring-loaded and which is cyclically moved up and down. The length of the pull of the pull guide is always slightly greater than the scatter width of the incoming scaled layers of sheets, plus a minimum pulling length of a few millimeters, up to the fixed side mark stop. The latter is adjustably fastened on the sheet-feeding table or on the comb plate, depending on the sheet format and the desired lateral position of the sheets running into the printing press.

These known pull guides have the disadvantage that they clamp the sheet from above and below in the course of pulling it [in]. For this reason, the pull guide must remain open at the end of the pulling operation until each sheet end has passed the pull guide line, i.e. until each sheet end has cleared it. Only then can the successive sheet, which is already located in the front marks, be pulled by the pull guide. The [respectively] third sheet of the incoming stream of scaled sheets must be sufficiently remote from the front marks and the pull guide line so that it has not yet reached the clamping pull guide working on the second sheet, i.e. is closed.

For rapidly running sheet printing presses, it is customary to keep the plate cylinder and the rubber blanket cylinder[s] as small as possible. In that case, the paper running times are shorter, and the manufacturing expenses are less. The sheet length often can be 3/4 to 5/6 of the plate cylinder circumference, so that [i.e.] the cylinder grooves are short and the sheets follow each other very closely. Clamping pull guides can no longer function, because the long sheets clear the pull guide lines too late for the clamping pull guides to pull [pulling] the next sheet. In these cases, suction pull guides are used, in which suction pull guides the pressure roller extending down from above, is omitted.

A driven suction pull guide strip is located in the feed table and pulls each sheet in by the provision [means] of a sufficient number of small suction air holes, and pulls each sheet [it] transversely, in relation to the running direction of the sheets, against a fixed side mark. In this case, the suction air is adjusted so finely, for each paper thickness up to cardboard [so finely], that each sheet is pulled by the suction orifice against the side mark by the use [means] of static friction and is deposited there, while the sliding friction, which now starts automatically, allows the further movement of the suction strip up to dead center.

Thus, known suction pull guides only act on the sheet from below without any clamping effects. They make possible an operation in the covered state of the preceding sheet end, and therefore accomplish greater sheet output per hour than prior clamping pull guides. However, it is disadvantageous that the third successive sheet, which is moved in underneath the sheet [respectively] to be aligned in the scaled flow, must not reach the working pull guide, [-] the

same as with clamping pull guides, [-] because it cannot get through between the second sheet that is grasped by [means of] suction, and the suction orifice. It can only do so if the suction pull guide does not operate, i.e. if the suction pull guide is "open" for sheets moving up from below.

The disadvantages of the generally known clamping and suction pull guides for the lateral alignment of sheets could be avoided if a lateral pulling device operating from above were provided.

DE 33 05 219 C2 describes the employment of a suction pull guide for very short scale distances, which suction pull guide is operating from above.

A device for the lateral alignment of sheets is known from DE 100 55 564 A1. An [, wherein an] effective suction surface is greater in the conveying direction of the sheets than in the transverse direction.

DE 33 02 873 C2 discloses a suction gripper acting from above, which suction gripper is lifted for further conveying a successive sheet underneath the sheet which is just to be aligned.

DE 11 10 656 B shows a back-and-forth pivotable suction segment for the lateral alignment of sheets.

USP 2,167,823 discloses a device for aligning sheets transversely with respect to the sheet running direction. A holding device for transporting a sheet is arranged to move the sheet against a side mark, and at least two sheets are arranged on top of each other in a scaled manner in the sheet running direction. An effective holding surface extends in the sheet running direction, which surface is longer in the longitudinal direction than in the transverse direction, and

wherein the holding device is arranged for acting from above on the sheet. In this case, three sheets are simultaneously arranged in the area of the holding device.

DE 2735 711 A1 shows a device for the lateral alignment of sheets by the use of a suction strip acting from below.

DE 27 11 554 A1 and DE 653 308 C each describe a device for aligning sheets. An end of an already aligned sheet trailing in the sheet running direction is again moved away from a side mark transversely to the sheet running direction.

DE 198 22 307 A1 discloses a device for aligning sheets transversely in respect to the sheet running direction. A transport roller, which transport the sheet from underneath, moves the sheet against a side mark and perform 1/N revolutions per sheet to be aligned.

A device for the lateral alignment of sheets by the use of circulating suction rollers acting from above is known from USP 1,728,329.

SUMMARY OF THE INVENTION

The object of the present invention is directed to [based on] providing devices for aligning sheets, and to providing a method for aligning sheets transversely to the direction of travel of the sheets.

In accordance with the present invention, this object is attained by the provision of a device for aligning sheets transversely to a sheet running directiong. A holding device, which transports the sheet form above, is used to move the sheet against a side register mark. At least two sheets are arranged above each other in a scaled fashion in the sheet running direction. The holding device is provided in the form of at least one suction roller which is rotatable. The suction roller may make one half turn for each sheet to be aligned. The suction roller has a plurality of segments with suction holes. Each segment pulls up a different sheet to be aligned, by suction [means of the characteristics of claims 1, 2, 4, 5, 7 or 29].

The advantages to be gained by [means of] the present invention lie, in particular, in that a suction pull arrangement, which acts from above, operates without clamping effects. It allows, for the first time, the passage underneath the pull guide line by the following sheet while the pull guide still pulls a previous sheet, which has been placed against the front marks, laterally against a fixed lateral edge stop.

By virtue of the provision and use of the novel "suction pull guides from above", of the present invention, the sheets can run in an advantageous manner at very close scale distances, i.e. they can run considerably slower, on the feed table to the front marks and reach them at an earlier time, because there is no longer an entering blockage for the sheets. The pull guide line is always open, because all clamping effect toward the bottom to the feed table is missing [lacking]. Because of the early arrival of the sheets at the front marks, considerably longer time frames are available

for sheet front and lateral edge alignment. This permits correspondingly higher machine speeds, without keeping the actual alignment times in milliseconds shorter than customary.

In a further embodiment of the "suction pull guide from above", in accordance with the present invention, it can be combined with the small lateral offset, which is known per se, of the sheets entering the printing press. In this case, the suction pull guide from above can [already] operate, even if the sheet end of the previous sheet still covers the pull guide line, while simultaneously a successive sheet also passes underneath the pull guide line. In this novel way, there are not only two sheets, as has been the case up to now, but three sheets simultaneously in the area of the pull guides. This explains how, in spite of considerably greater numbers of revolution of the press, identical or longer sheet alignment times are made available by the provision of suction pull guides which operate from above.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred [An exemplary] embodiment of the present invention is represented in the drawings and will be described in greater detail in what follows.

Shown are in:

Fig. 1, a top plan view of the left corner of a [the] feed table in accordance with the present invention [from above], in

Fig. 2, a cross-section through the suction pull guide in the feed table, in

Fig. 3, a side elevation view, partly in cross-section of the drive mechanism of the shiftable suction roller, in

Fig. 4, a way/time diagram of the sheet feeding device with a classic pull guide, and in

Fig. 5, a way/time diagram of the sheet feeding device with the side mark in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Several front marks 02 are located on a feed table 01 in Fig. 1, which open toward the bottom. There are side marks 03 with cover marks 04. The cover marks 04 are located underneath a suction roller 05 and in the grooves of the suction roller 05 [latter]. The suction roller 05 has two diametrically oppositely located rows of suction holes 06, of which the upper row of suction holes 06 is visible in Fig. 1. The suction roller 05 has axle journals that rotate in two bearing arms 07, which are adjustably fastened on the feed table outside of the paper format. Suction air is conducted into the suction roller 05 through a hose 09 and is conducted to the inside of the suction tube wall by [means of] a slit mouthpiece 22, which can only be seen in Fig. 2. The axis of rotation of the suction roller 05 is located parallel with the running direction L of the sheets and is positioned in the vicinity of the lateral sheet edge to be aligned. Driving of the suction roller 05 for rotation about its axis of rotation is provided, as seen in Figs. 1 and 3, via a toothed belt pulley 14, a toothed belt 15 and a pinion 16 of a constant speed shaft located in the sheet delivery device or on the printing press or, for example, via its own rpm- or positionally- regulated electric drive mechanism by

the use [means] of an electronic shaft.

In accordance with the depiction of the suction roller 05 shown in Figs. 1 to 3, the two suction hole rows 06 of the suction roller 05 are spaced so that they rotate at half turns, i.e. the suction roller 05 is arranged in such a way that it performs half a turn for each [per] sheet 10, 11, 12 to be aligned. The suction roller 05 preferably has a [an advantageous] diameter between 50 and 60 mm. It can also be constructed differently, for example with the suction hole rolls 06 spaced for one-third turns.

The [Accordingly, the] suction roller 05 is arranged in such a way that it performs 1/N revolutions per sheet 10, 11, 12 to be aligned, wherein N = 2, 3, 4 ..., i.e. N is a whole number greater than 1 [2].

[The suction roller 05 is arranged to perform 1/N revolutions per sheet 10, 11, 12 to be aligned. In this case N = 2, 3, 4 ..., i.e. a whole number greater than 2.]

Fig. 1 shows a sheet 10 running into the printing press via front marks 02, which sheet 10 is, after lateral alignment at side marks 03, grasped by a conventional sheet feeder, for example from below by the use [means] of a swinging gripper, or by the use [means] of suction-push feeders from below, while lying in the front marks 02, and is pulled off the feed table 01 under acceleration. In the course of this sheet movement, the sheet feeder is axially offset, in a direction [i.e.] transversely to the sheet running direction L, by an always constant amount A of, for example, 26 mm. Because of this axial offset, the narrow suction slit, which is located approximately underneath the center axis of

the suction roller 05 and having a width of 6 mm, for example, is uncovered over its entire suction roller length from the lateral edge of the outrunning first sheet 10.

Fig. 1 shows that the end of the sheet 10 has not yet left the area of the suction roller. However, the lateral displacement A of the first sheet 10 makes it possible for [that] the suction roller to have [has] already actively pulled the next, second sheet 11, which is already located in the front marks 02, toward the left against the side marks 03. The sheet feeding of this second sheet 11 can start soon, even if the end of the first sheet 10 still covers the front marks 02.

A third sheet 12, which has already arrived in the area of the suction roller 05, slowly moves in the direction toward the front marks 02. Since it lies underneath the second sheet 11, which second sheet 11 is just being pulled against the side marks 03 by the suction roller 05 acting from above, as seen in Fig. 2 the suction roller 05 cannot yet grasp the third sheet 12 by use [means] of its suction. This grasping of sheet 12 by the roller 05 only takes place in the next time period, when the second sheet 11, now laterally displaced by the distance A, in [-] the same way as was done with [now] the first sheet 10, now [-] enters into the press and uncovers the suction slit in the suction roller 05 for the third sheet 12, etc. A tolerance strip 13 of, for example, ± 6 mm has been drawn in Figs. 1 and 2 in hatched lines. The individual scaled, imbricated or overlying sheets move, with this maximum amount of scattering, on the feed table 01 from the sheet feeder into the front marks 02. The active narrow, but long suction conduit of the suction roller 05,

which is located above the stream of sheets, is located underneath the center line of the suction roller 05, and between the sheet inlet tolerance strip 13 and the lateral edge of all arriving lateral sheet edges, which arriving lateral sheet edges are offset, by the amount A_1 from the side marks 03. This is the strip identified by B in Figs. 1 and 2. With this arrangement, the suction roller 05 catches all sheets 10, 11, 12 of the scaled stream arriving inside the tolerance strip 13, but not the offset lateral edges of all incoming sheets 10, 11, 12.

The ratio of the effective holding surface in the longitudinal direction l05 to the effective holding surface in the transverse direction b05 of the suction roller 05 should be greater than 3, and preferably should be greater than 5.

The three sheets 10, 11, 12 are arranged between two straight lines 23, 24, which straight lines 23, 24 delimit the effective holding surface of the holding device, such as the suction roller 05 and which straight lines 23, 24 extend transversely with [in] respect to the running direction L of the sheets.

Fig. 2 shows the suction roller 05 located above the feed table/comb plate 01. The first sheet 10 enters the press from the feed table 01 offset from the side mark 03 by the distance A, for example 26 mm. Sheet 10 [It] lies to the right of the suction roller center outside of the suction air slit mouthpiece [conduit] 22.

The second sheet 11, which is entering the fee table 01, is pulled against the side mark 03 by one of the two raised suction air segments with suction holes 06 of the suction roller 05. Several cover marks, or guide tongues 04, project past the side marks 03 into the grooves of the suction roller 05 as far as approximately the center underneath

the suction roller 05. The cover marks 04 prevent thin sheets 10, 11, 12 from arching in the nip formed between the feed table 01, the side mark 03 and the suction roller 05 when these sheets are coming into contact with the side marks 03.

The two active suction hole segments 06 of the suction roller 05 are located diametrically opposite each other and, with a suction roller 05 revolving at half turns, are approximately 30° to 40° in arcuate length [long], so that a long pulling time angle of approximately 90° and a pulling path of the suction roller 05 of approximately 20 mm results.

The revolving suction roller 05 itself can provide the clocked, or timed switching on and off of the suction air for lateral pulling. For this purpose, suction air holes 06 are only located in the two oppositely placed 30° to 40° [45°] segments. A stationary pipe 21 is located inside the revolving suction roller 05, and acts as the suction air supply over the entire length of the suction roller 05. The pipe 21 has a downward oriented air slit or slit mouthpiece 22 of a width of, for example, 6 mm over the length of the suction roller 05.

It is also within the scope of the present invention [conceivable] that the suction roller 05 has suction holes 06 all around its periphery, that it revolves rhythmically or freely, and that the suction air is supplied in a clocked or timed manner via a slit- like mouthpiece 22 inside the suction roller 05, and which is directed downward.

In the circumferential direction, the suction roller 05 has several arcuately spaced segments with suction holes 06, wherein each segment picks up a different sheet 10, 11, 12 to be aligned by the use [means] of suction. The suction roller 05 preferably has two segments with suction holes 06 in the circumferential direction, as depicted in Fig. 2.

Where, in accordance with Fig. 2, the cover marks/guide tongues 04 are located in the bottom of the suction rollers, i.e. near the suction roller grooves, the suction slit 22 in the pipe 21 is not cut through in the area of the suction roller grooves, which increases the stability of the suction pipe 21. The vacuum is switched extremely rapidly, since it is maintained in the pipe 21 and only the air holes 06 close to the slit mouthpiece 22 must be emptied or evacuated by suction. With the suction tube 05, the outer walls of the suction tube 05, [spaces] between the two active suction elements 06, have been placed slightly radially inwardly [lower]. This makes it easier for the offset first sheet 10, which are now running into the press, to leave the feed table 01 without interference with the outer wall of the suction tube 05 as they pass next to and parallel with the suction roller center.

In Fig. 3, the incoming third sheet 12 is located within the scale tolerance strip 13, to the right of the side mark 03 and to the left of the center of the suction roller 05, so that it lies [i.e.] actually in the suction area 22. However, since the second sheet 11 still lies on top of the third sheet 12, and the second sheet 11 is pulled against the side mark 03 by the suction roller 05 from above, the third sheet 12 cannot yet be pulled up by suction by the suction

roller 05 because it is covered by the second [first] sheet 11. In spite of the operating side pull mark 03, the third sheet 12 can continue to move unhindered in the direction of the front marks 02.

Fig. 3 illustrates an example of a [the] drive mechanism for the suction roller 05 which is located above the feed table 01, and which suction roller 05 is driven at half turns by a cooperating [means of the] gear wheel or toothed belt pulley 14, toothed belt 15 and drive wheel or pinion 16. Bevel wheels or gears 17, 18 above the feed table 01 are connected by a vertical shaft 19 with 2:1 bevel wheels or gears 30, 31 underneath the feed table 01. A feather key 32 has been screwed into the bevel wheel 31 and engages a continuous groove 33 of a single turn shaft 34, which rotates transversely underneath the feed table 01. A slit, which can be covered over, is located in the feed table 01 above this single turn shaft 34 for letting the vertical bevel wheel drive shaft 19 through from below to above. In this way, the entire unit, consisting of the suction pull mark with drive mechanism, can be shifted transversely in relation to the sheet running direction L, depending on the sheet width, to SI or [(]control side[)] or, with a mirror-reversed suction pull mark unit, to SII or [(]drive side[)] of the printing press.

It can also be seen in Fig. 3 that, for gaining sheet- feeding time, three sheets are, in accordance with the present invention, simultaneously present in the pull mark area in a novel way, while in the previous, customary way there have been only two sheets up to now.

Fig. 4 represents a way/time diagram of the sheet feeding device with a classic or prior art pull guide ZM in a position of -150 mm from the zero line. The abscissa describes the active time angle of a single turn shaft, for example of a plate cylinder, from 0° to 360°, the ordinate shows the sheet travel in mm.

The first sheet at the left outside is accelerated in the 90° time angle, for example by the use [means] of swinging auxiliary grippers, in a parallel manner to the circumferential speed of the cylinder, and leaves the front mark line in the form of a 45° straight line equal to the abscissa.

A second sheet runs more slowly in the sheet stream with a scale length SL = 300 mm and encounters the front marks at 210°. It is in contact with the front mark over 80°, i.e. until 290°. Then the classic lateral pull mark is engaged, which had already been released from the outgoing first sheet of a maximal length of 720 mm. The pulling time is 60° until the pull mark opens at 350°. Only then is the third sheet 12 allowed to pass through the pull mark line -150 mm of the front marks which, with a 210° arrival point forces, the relatively large scale distance of SL = 300 mm. Sheets of excess length of, for example 850 mm length, cover the pull mark. In that case, it must be a suction pull mark from underneath.

Fig. 5 represents an improved way/time diagram with the side pull mark in accordance with the present invention, which pulls the sheet by the use [means] of suction only from above. The beginnings of the sheets and the ends of the sheets move the same as depicted in Fig. 4. The second sheet arrives considerably earlier at the front

marks, namely at 140°, and has a contact time of 120° until 260° when the pull mark starts.

The scale distance SL is only 180 mm, because the third sheet need not wait for the opening of the pull mark, as was the case in Fig. 4. The third sheet 12 can pass underneath the working pull mark and can therefore already be in the 120 mm long area of the pull mark suction roller of 250 mm - 130 mm. This [, this] permits the more advantageous, because it is shorter, scale distance of only 180 mm.

At a normal maximum sheet length of 720 mm, the sheet end passes the pull mark suction roller before the latter begins to operate from 260° to 350°, i.e. with a 90° pull time.

With sheets of excess length, for example 850 mm long, or 306° of 1000 mm cylinder circumference, single turn, the outgoing end covers the working suction pull mark. In such cases, the outgoing sheet must be laterally offset, for example by 26 mm, in order to release the pull mark in good time at 260°.

The comparison of Fig. 4 with Fig. 5 shows that the feed times are longer by 50%, namely at the front marks 120° instead of 80°, and at the lateral pull value 90° instead of 60°. This is possible because not only the respectively second sheet, but also already the third sheet, can be in the area between the pull mark mechanism and the front marks 02. This allows, at the same time, an advantageously short scale distance at a lesser speed and with less danger of rebound when contacting the front marks.

[The invention is not limited to the exemplary embodiment.]

Which preferred embodiments of devices for arranging sheets and method for aligning sheets transversal to the direction of travel of the sheets, in accordance with the present invention, have been set forth fully and completely hereinabove, it will be apparent to one of skill in the art that various changes in, for example, the type of feed table, the source of the suction, the type of drive gears, and the like could be made without departing from the true spirit and scope of the present invention which is accordingly to be limited only bye the appended claims.

WHAT IS CLAIMED IS:

[List of Reference Symbols

01 Feed table

02 Front mark

03 Side mark

04 Cover mark, guide tongue

05 Holding device, suction roller

06 Suction holes, suction air holes, suction segments, holding surface

07 Bearing arms

08 -

09 Hose

10 Sheet, first

11 Sheet, second

12 Sheet, third

13 Tolerance strip]

[14 Toothed belt pulley

15 Toothed belt

16 Drive wheel

17 Bevel wheel

18 Bevel wheel

19 Shaft, vertical, bevel wheel driveshaft

20 -

21 Pipe

22 Air slit, slit mouthpiece

23 Straight line

24 Straight line

25 -

26 -

27 -

28 -

29 -]

[30 Bevel wheel

31 Bevel wheel

32 Feather key

33 Groove

34 Single turn shaft

A Constant amount, distance

B Constant amount, distance

L Running direction, sheet running direction

l05 Length of the holding surface, longitudinal direction

b05 Width of the holding surface, transverse direction

ZM Pull mark

VM Front mark

SL Scale length, scale distance]